

**UNDERGROUND INJECTION CONTROL
PERMIT APPLICATION**

Ute Tribal # 04-04
1205' FNL & 660' FWL
Sec. 4, T5S-R3W
Duchesne County, Utah
API # 43-013-31574

July 2015

Prepared for:
Bruce Suchomel
Groundwater Program, Mail Code 8P-W-UIC
U.S. Environmental Protection Agency
1595 Wynkoop St
Denver, CO 80202-1129

Prepared by:
Petroglyph Energy, INC.
960 Broadway Avenue, Suite 500, P.O. Box 70019
Boise, Idaho 83707
(208) 685-7600
FAX (208) 685-7605

LIST OF ATTACHMENTS

- | | |
|-------------------|---|
| Attachment No. 1 | Area Topography Map |
| Attachment No. 2 | Site Map |
| Attachment No. 3 | Map of the A-Marker surface |
| Attachment No. 4 | Cross-Sections of the injection formation |
| Attachment No. 5 | Water Analysis |
| Attachment No. 6 | Completion data for all wells in the AOR |
| Attachment No. 7 | CBL for the UIC well |
| Attachment No. 8 | Open hole log for the UIC well |
| Attachment No. 9 | List of owners and Affidavit Notification |
| Attachment No. 10 | Well bore diagrams for the UIC well |
| Attachment No. 11 | P&A procedure |
| Attachment No. 12 | MIT procedure |
| Attachment No. 13 | Surety Bond letter |

**SUMMARY DOCUMENT
UIC WELL APPLICATION
Ute Tribal 04-04
API # 43-013-31574**

The following document contains information provided in support of the application for the conversion of the Ute Tribal 04-04 well to an injection well in the Green River formation in the Antelope Creek Field in Duchesne County, Utah.

The Antelope Creek Field falls within the Uintah and Ouray Indian reservations and is within Indian Country; therefore, for facilities located on the reservation, only EPA-issued UIC permits are necessary for compliance with UIC regulations.

The EPA has issued an Area Permit #UT20736-00000 for the Underground Injection Control for the Antelope Creek Field. This area permit allows for additional producing wells to be converted to injection wells for enhanced recovery.

- (1) Petroglyph Energy, Inc. (Petroglyph) is the operator and only working interest owner of wells located in the Antelope creek Field, Duchesne County, Utah. Petroglyph's business address is provided below:

Petroglyph Energy, Inc.
960 Broadway Avenue, Suite 500
P.O. Box 70019
Boise, ID 83707

- (2) Enclosed as Attachment No. 1 is a topographic map of a portion of the Antelope Creek Field, identifying all wells located in this area. The legal location for the Ute Tribal 04-04 is 1205' FNL & 660' FWL Lot 5 Sec. 4, T5S-R3W.
- (3) Attachment No. 2 is a map of the well. This map shows a circle with a ¼ mile radius centered on the Ute Tribal 04-04 well. The ¼ mile radius encompasses the area of review, AOR, within which Petroglyph is required to investigate all wells for mechanical integrity. The ¼ mile radius also identifies mineral ownership; those lands, and the the owners thereof, which must be provided notice of this application. The AOR has Ute Tribal 33-13N-D3, Ute Tribal 05-01, Ute Tribal 04-06B, and Ute Tribal 04-08A well(s) located in its ¼ mile radius.

- (4) Petroglyph proposes to utilize the Ute Tribal 04-04 as an injection well for enhanced recovery in the Antelope Creek Field.
- (5) Injection Zone – The injection intervals are between 4080' and 6082' True Vertical Depth and located in the lower portion of the Green River Formation. The injection zone is confined within a 2002' section between the Green River "A" Lime marker bed and the top of the Basal Carbonate in the lower part of the formation. The injection zone is composed of lenticular calcareous sandstones interbedded with low permeable carbonates and calcareous shales. The lenticular sandstones vary in thickness from 1 to 30 feet.

Confining Zone – The overall confining strata above the injection zone consists of impermeable Green River calcareous shales and continuous beds of microcrystalline dolostone. The confining zone in the Ute Tribal 04-04 is 243 feet thick.

Attachment No. 3 is a structure map of the A-Marker surface.

Attachment No. 4 is a cross-section of the injection interval and confining zone.

- (6) Enclosed as Attachment No. 5 are standard analyses of produced water from three batteries that currently serve as central handling facilities for all project producing wells. The analysis of the Green River formation water from the Ute Tribal 18-08 Satellite Battery is 12805 mg/L of total dissolved solids (TDS), Ute Tribal 21-11 Satellite Battery is 15659 mg/L TDS, and Ute Tribal 34-12-D3 Satellite Battery is 14590 mg/L TDS.

Injectate in the field is a mixture of produced water and fresh make-up water. The nearest injection well is the Ute Tribal 04-05, the most recent analysis of the water being injected into the Green River formation at this location is 3302 mg/L TDS. This analysis is also included in Attachment No. 5.

- (7) A summary of completion data from the Ute Tribal 04-04 and offset wells in the AOR are included in Attachment No. 6
- (8) The cement bond log is included in Attachment No. 7.
- (9) The open hole log for the Ute Tribal 04-04 is included in Attachment No. 8.

(10) The Antelope Creek Field is operated under a Cooperative Plan of Development between the Ute Tribe and Petroglyph Energy. At the Ute Tribal 04-04 location, all mineral owners, surface owners and operators located within the AOR ¼ mile radius have been notified of the submitted EPA application to convert to injection. Attachment No. 9 is the Affidavit of Notification to all owners.

(11) Petroglyph requests a maximum surface injection pressure of **1900psi**. The EPA Area Permit No. UT20736-00000 uses the formula:

$$P_m = (0.88\text{psi/ft} - 0.43\text{psi/ft}(S_g)) D$$

Where:

P_m = Maximum surface injection pressure

0.88psi/ft = Fracture gradient

D = Top perforation depth

0.43psi/ft = Hydrostatic pressure/hydraulic head

S_g = Specific gravity of injection fluid

For the Ute Tribal 04-04:

$$\mathbf{2032\text{psi} = (0.88\text{psi/ft} - 0.43(1.00)) 4516\text{ft}}$$

EPA Area Permit No. 20736-00000 further caps maximum surface pressure at 1900psi.

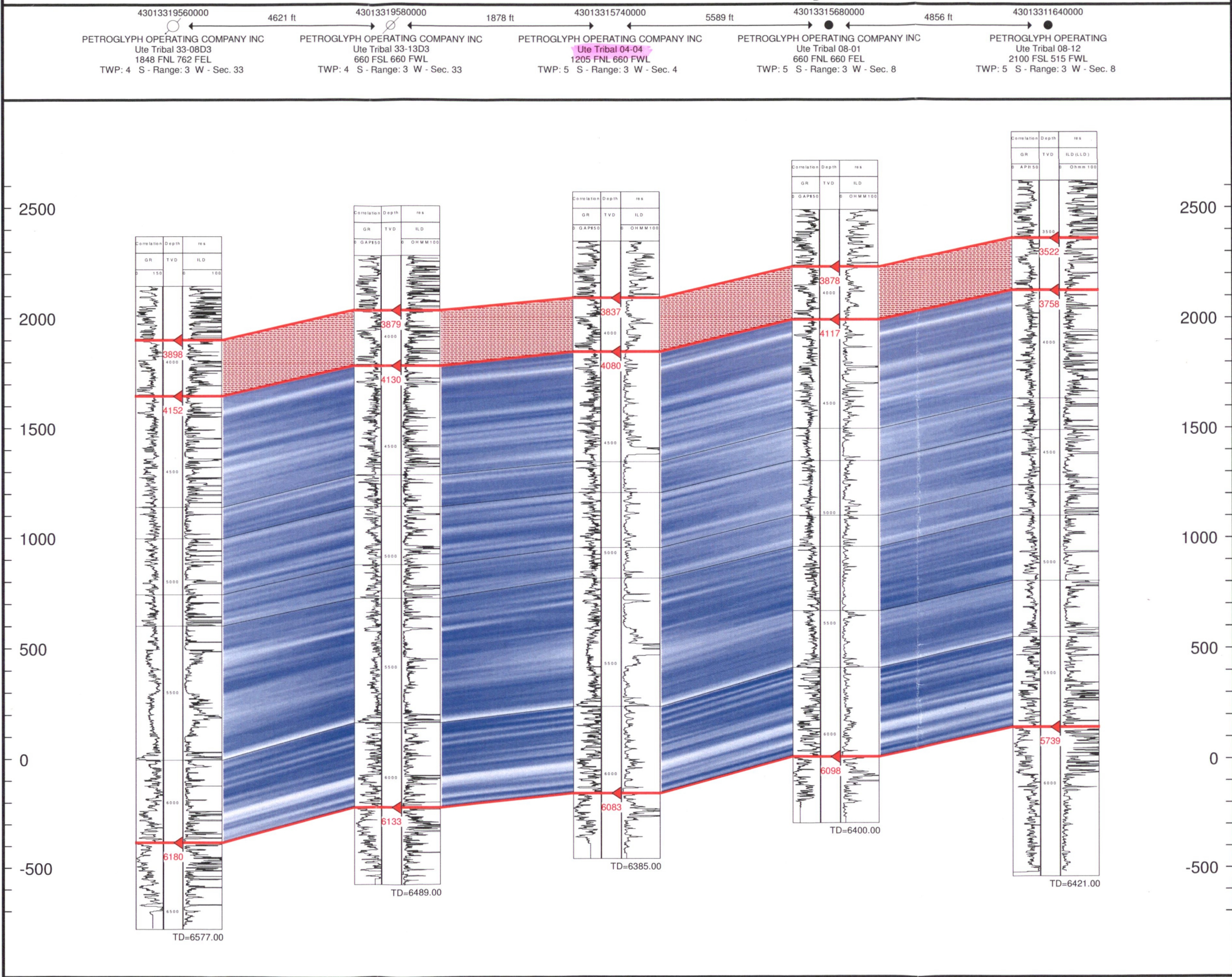
(12) Three wellbore diagrams for the Ute Tribal 04-04 are in Attachment No. 10. One diagram is for production, one for injection, and one for Plug & Abandonment (P&A).

(13) The P&A procedure for this well is shown in Attachment No. 11.

(14) Once the draft permit is issued, Petroglyph will conduct a Mechanical Integrity Test and a static bottom-hole pressure test. The MIT procedure is contained in Attachment No. 12. The conversion work will be satisfactorily completed and submitted to the EPA on Form 7520-12. A wellbore schematic will be included with this form.

- (15) Petroglyph will give proof of financial responsibility by posting a surety bond for the UIC well prior to final permit approval. A copy of this letter is contained in Attachment No. 13.
- (16) Petroglyph will install various gauges on the well so that the injection pressure and tubing/casing annulus pressure can be monitored. The well will be equipped with a flow meter with a cumulative volume recorder.

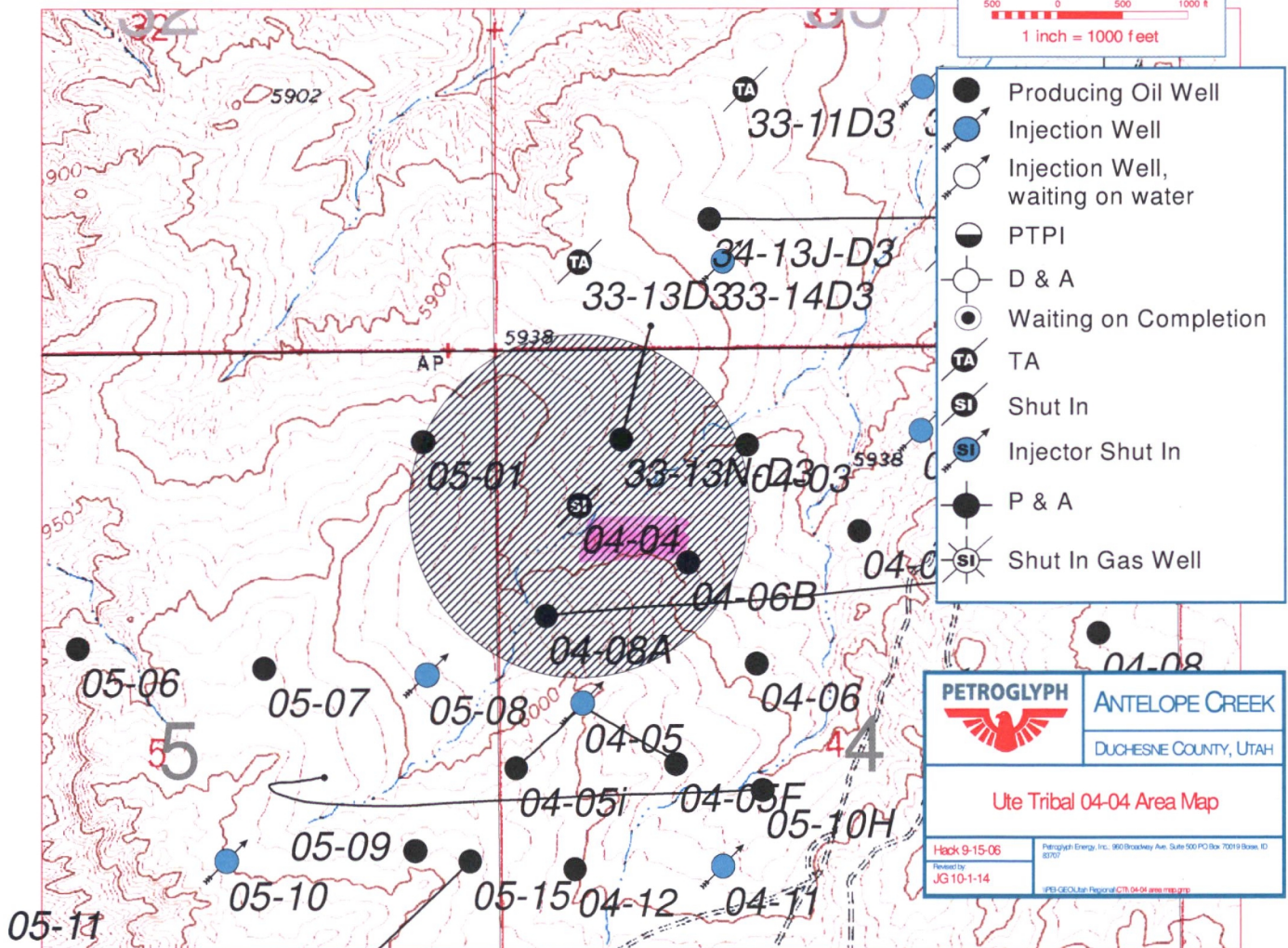
Structural Cross Section A to A' in the Vicinity of Ute Tribal 04-04



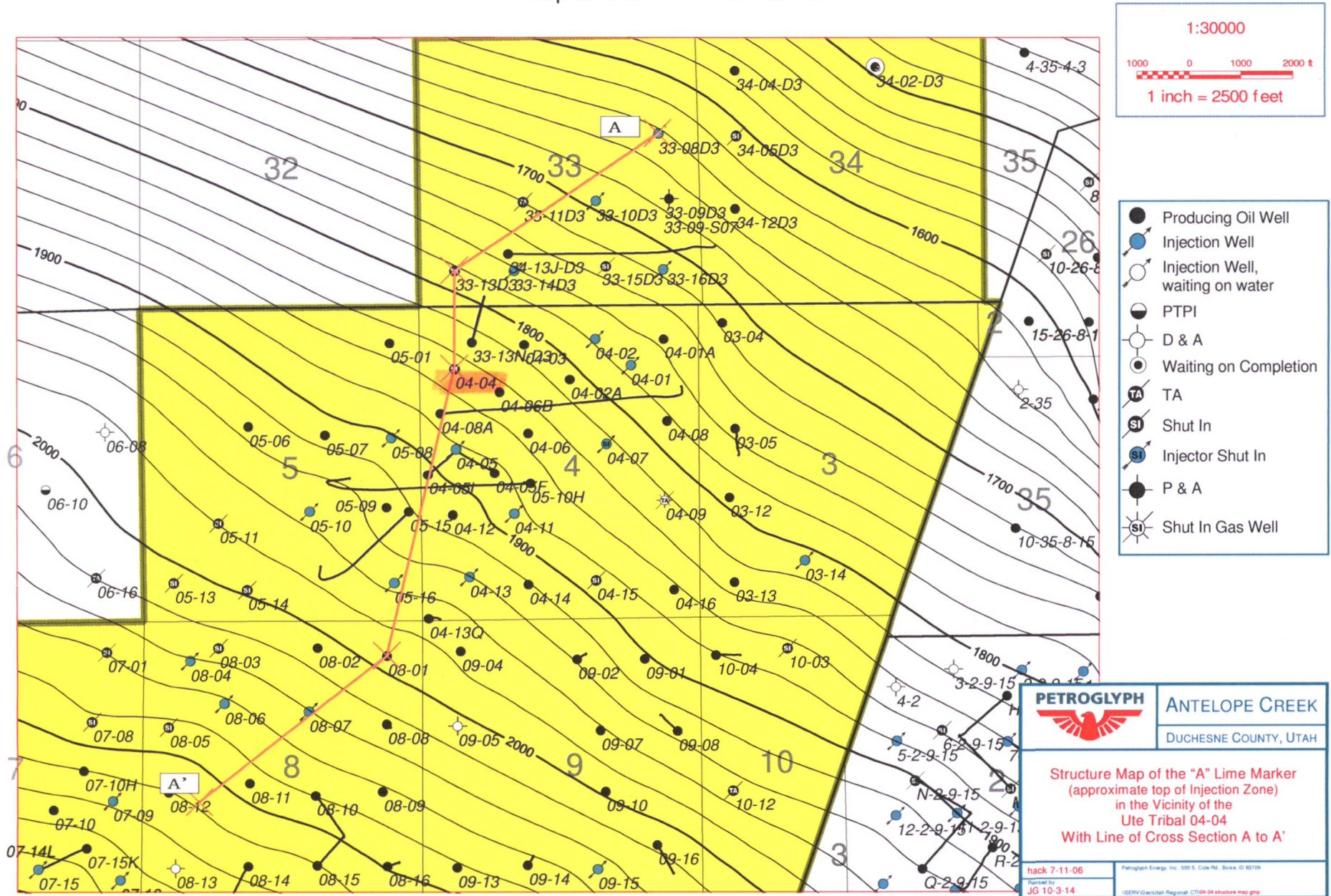
1:12000

500 0 500 1000 ft

1 inch = 1000 feet



ATTACHMENT NO. 3: Map of the "A" Lime Marker



Ute Tribal 04-04 Well History

Well History:

Spud Well: 1/6/1996
Completed: 3/29/1996
First Production: 3/30/1996

Tops (KB):

BMSW* Found at 937'
Green River 1405'
A Marker 4080'
X Marker 4578'
Douglas Creek 4720'
B Limestone 5110'
Castle Peak 5686'

Basal Carbonate 6082'

Perf History:

3/14/1996

D7	5447' to 5453'
D7	5418' to 5422'
D7	5408' to 5412'
D7	5387' to 5390'
D7	5380' to 5382'
CICR	set at 5634'

3/15/1996

D3	5212' to 5216'
D3	5182' to 5186'

3/19/1996

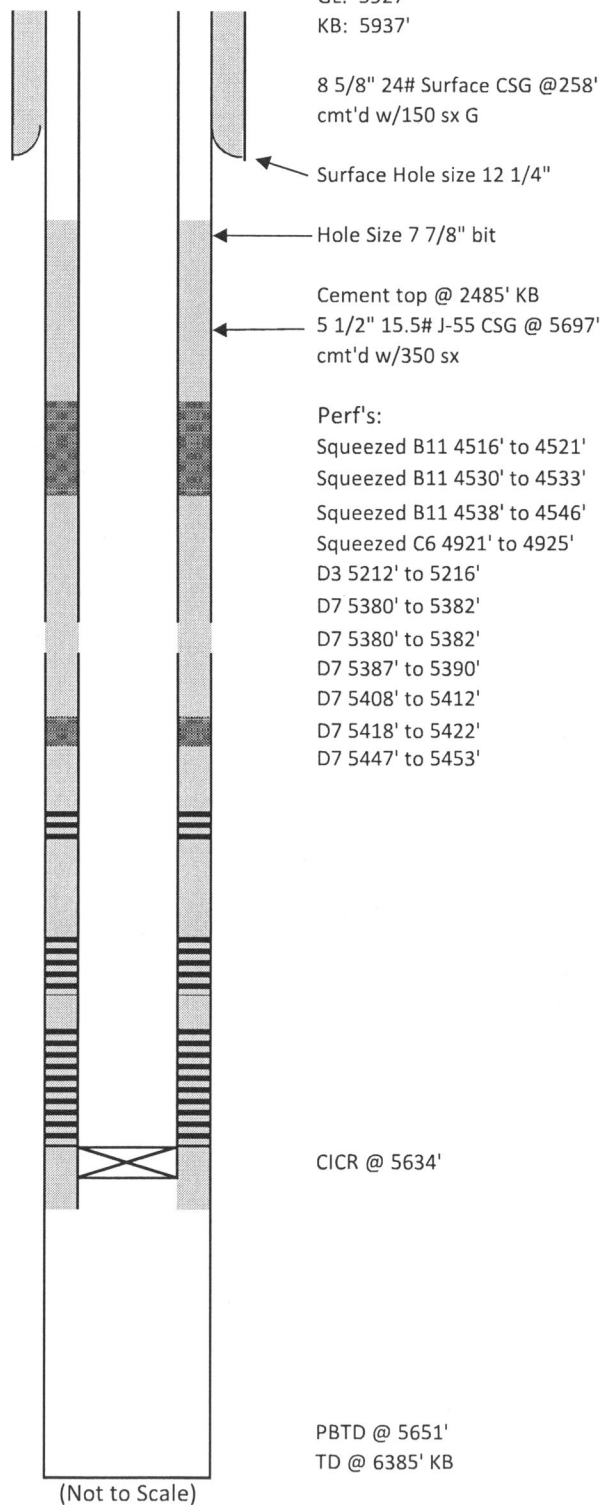
C6	4921' to 4925'	Squeezed 9/14/2001
----	----------------	--------------------

3/22/1996

B11	4538 to 4546'	Squeezed 9/14/2001
B11	4530 to 4533'	Squeezed 9/14/2001
B11	4516 to 4521'	Squeezed 9/14/2001

Petroglyph Operating Co., Inc.
Ute Tribal #04-04
(660' FWL & 1205' FNL)
Lot 5 Section 4 - 5S - 3W
Antelope Creek Field
Duchesne Co. Utah
API#: 43013315740000

*Plate 1 Utah Geological Survey Special Study 144. (2012). *BMSW Elevation Contour Map, Uinta Basin, Utah*, [map]. (CA 1:200,000)



Ute Tribal 04-04 Injection

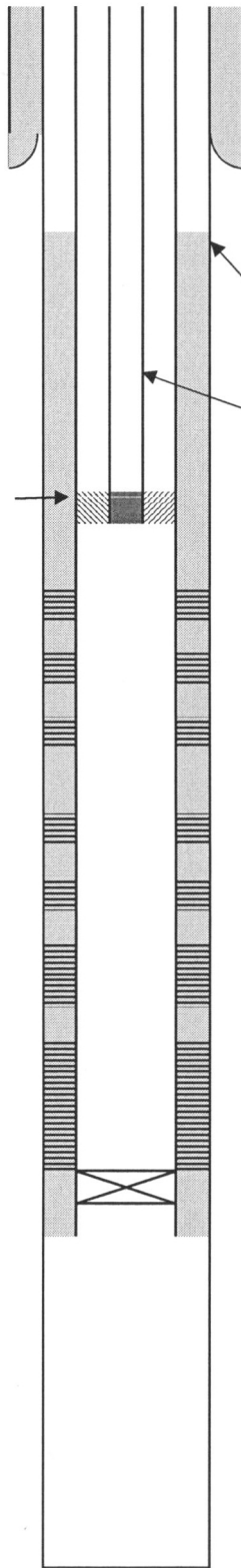
Well History:

1/6/96 Spud Well
 3/29/96 Completed
 3/30/96 First Production

Tops (KB):

BMSW* Found at 937'
 Green River 1405'
A Marker 4080'
 X Marker 4578'
 Douglas Creek 4720'
 B Limestone 5110'
 Castle Peak 5686'
Basal Carbonate 6082'

Injection Packer @ 4426'



GL: 5927'

KB: 5937'

8 5/8" 24# Surface CSG @258'
 cmt'd w/150 sx G

Surface Hole size 12 1/4"

Hole Size 7 7/8" bit

Cement top @ 2485' KB
 5 1/2" 15.5# J-55 CSG @ 5697'
 cmt'd w/350sx

Tubing 2 7/8" 6.5# J55

Perfs:

Re-perf B11 4516' to 4522'
 Re-perf B11 4530' to 4534'
 Re-perf B11 4537' to 4549'
 Add C5 4774' to 4776'
 Re-perf C6 4921' to 4925'
 D3 5212' to 5216'
 D7 5380' to 5382'
 D7 5387' to 5390'
 Add D7 5390' to 5394'
 D7 5387' to 5390'
 D7 5408' to 5412'
 D7 5418' to 5422'
 Add D7 5422' to 5428'
 D7 5418' to 5422'
 Add D7 5433' to 5447'
 D7 5447' to 5453'
 Add D7 5453' to 5459'
 Add D7 5485' to 5487'
 Add D7 5495' to 5499'

CICR @ 5634'

PBTD @ 5651'

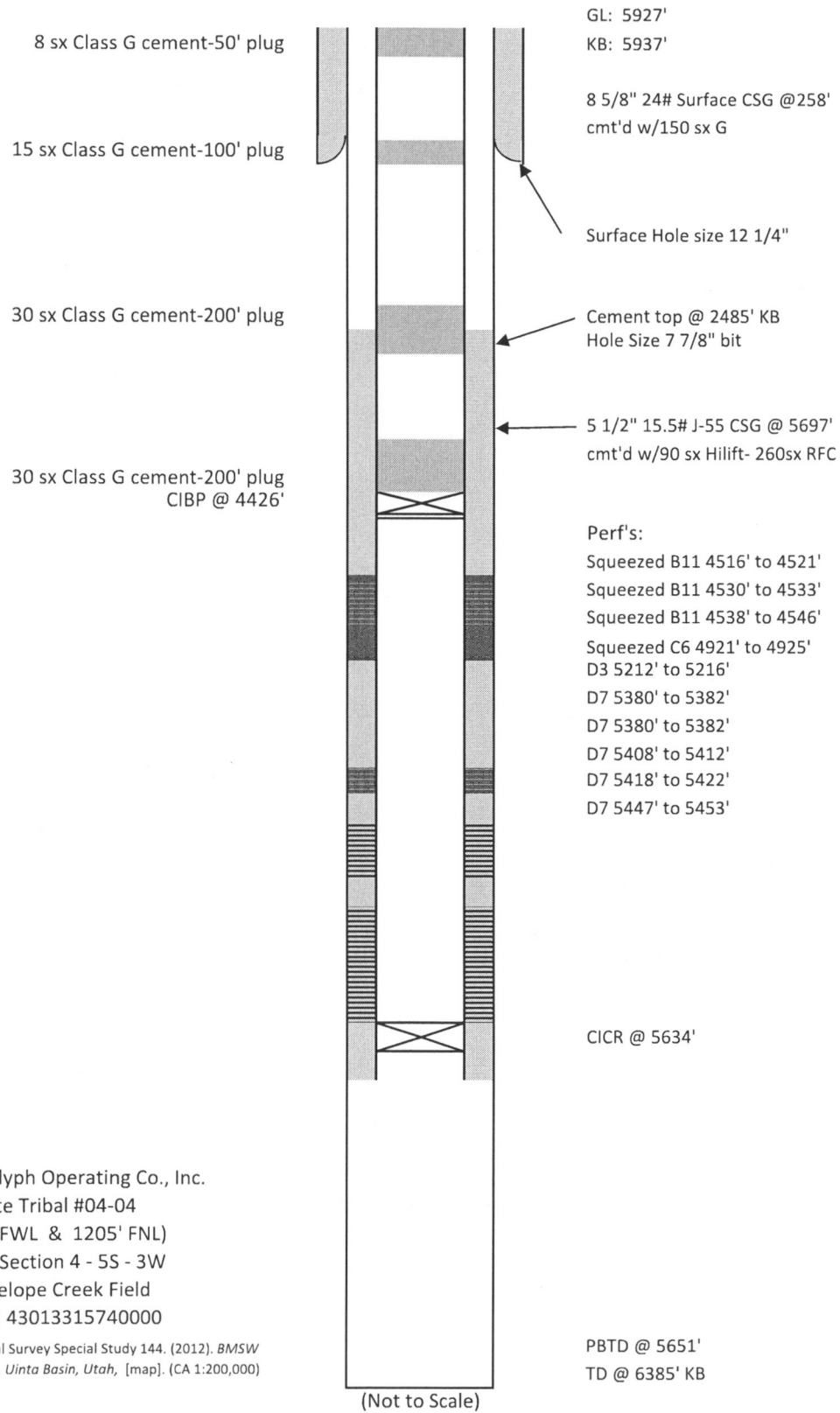
TD @ 6385' KB

Petroglyph Operating Co., Inc.
 Ute Tribal #04-04
 (660' FWL & 1205' FNL)
 Lot 5 Section 4 - 5S - 3W
 Antelope Creek Field
 Duchesne Co. Utah
 API#: 43013315740000

*Plate 1 Utah Geological Survey Special Study 144. (2012). BMSW
 Elevation Contour Map, Uinta Basin, Utah, [map]. (CA 1:200,000)

(Not to Scale)

Ute Tribal 04-04 Plug and Abandonment



Petroglyph Operating Co., Inc.
Ute Tribal #04-04
(660' FWL & 1205' FNL)
Lot 5 Section 4 - 5S - 3W
Antelope Creek Field
API#: 43013315740000

*Plate 1 Utah Geological Survey Special Study 144. (2012). BMSW
Elevation Contour Map, Uinta Basin, Utah, [map]. (CA 1:200,000)

Cement Bond Index (in millivolts - mV)

Date: August 21, 2015

Operator: Petroglyph

Well: Ute Tribal 04-04

Permit : _____

Enter the following values:

Amplitude at 0% Bond (A-0) (in mV) = 72 mV

Amplitude at 100% Bond (A-100) (in mV) = 1 mV

Amplitude at 80% Bond (A-80) = 2.4 mV

$$[(0.2)\log A0 + (0.8)\log A100]$$

Amplitude at 90% Bond (A-90)= 1.5 mV

$$[(0.1)\log A0 + (0.9)\log A100]$$

Amplitude at 70% Bond (A-70)= 3.6 mV

$$[(0.3)\log A0 + (0.7)\log A100]$$

Amplitude at 60% Bond (A-60)= 5.5 mV

$$[(0.4)\log A0 + (0.6)\log A100]$$

not 80 to 10

Maximum Allowable Injection Pressure (MAIP)
From Fracture Gradient

Date: 08/27/2015 Operator: Petroglyph
Well: UTE Tribal 04-04
Permit #: _____

Enter the following values:

Specific Gravity of injectate =	<u>1.010</u>	g/cc
Depth to top of injection interval =	<u>4,080</u>	feet
Fracture Gradient (F G) =	<u>0.880</u>	psi/ft

MAIP = **1,805** psig

(rounded down to nearest 5 psig)

where:

$$MSIP = [FG - (0.433 * SG)] * \text{Depth to top of injection interval} = 1806.094$$